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THE DERMESTID, TROGODERMA VERSICOLOR CREUTZER, A NEW PEST OF DRIED MILK PRODUCTS

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Early in 1933, Dr. E. G. Hood of the Dairy and Cold Storage Branch, Dominion Department of Agriculture, submitted to the Dominion Entomologist some specimens of dermestid insect larvae taken in a dried milk establishment at Princeton, Ont. These insects which were passed to me, resembled larvae of the buffalo carpet beetle. Adult beetles that emerged late in March and in April, however, showed the species to be *Trogoderma versicolor* Creutzer (det. W. J. Brown). Shortly after receiving the larvae the Dominion Entomologist instructed Mr. W. A. Fowler of our Toronto Plant Inspection Office to investigate the infestation. Mr. Fowler reported that larvae were found in the drying room of the plant in large cracks in the wooden floor and in the wooden trap-door of a hopper. Late in April I visited dried milk plants at Napanee and Sydenham with Mr. R. Elliott of the Dairy and Cold Storage Branch. At Napanee we learned that an infestation had been first noticed in 1930. It was in this year that specimens were received at Ottawa from Napanee constituting the first record of this species in Canada. At the time it was understood that the larvae were from the home of a correspondent and it was so reported by Gibson and Twinn (5, p. 28). We have since learned, however, that the specimens were taken from the dried milk plant in this locality. At the time of our visit no specimens of *T. versicolor* were seen and we were informed that as a result of the elimination of breeding places and the liberal use of hot water since the first discovery of the pest, the infestation had been negligible. Incidentally, the building was of modern construction and equipped with concrete floors throughout.

More recently the same species was found infesting a large milk powder plant at Woodstock, Ont., and there is reason to believe that other similar establishments may be infested. Mr. Elliott has informed me that several domestic shipments of milk powder have been returned, and at least one export shipment complained of, owing to the presence of these insects. The dried milk plants have a large and growing domestic trade and also export to the British market and elsewhere. The amount of damage the insects have done, so far, is comparatively unimportant, but the species is potentially dangerous, particularly in view of its recorded habits elsewhere.

Distribution: The species *Trogoderma versicolor* Creutzer, apparently is cosmopolitan. It has been recorded from Caucasia (1) and Georgia (7), U.S.S.R., Morocco (9), the island of Cyprus (13), India (4), Ontario (5), and the United States (2, 3, 6, 8, 10, 11, 12). In the United States it has been reported* (2, p. 386) to be generally distributed, but uncommon, and although able to feed on a large variety of substances is said to thrive best on cereals. In most of these regions is is noted as a pest of stored wheat and other cereals. In Texas and

*Under the synonym *T. inclusa* Lec.

Kansas the larvae were found infesting grain in rye straw used for filling horse colars (2). The leather of collars stuffed with infested straw was badly damaged by reason of the holes made by the larvae.

Life-history: The life history is imperfectly known, but appears to be similar to that of other dermestid insects such as the black carpet beetle and the buffalo carpet beetle. The beetles commence to emerge in early spring when they may be observed in infested buildings endeavouring to find their way to the outdoors through windows. Beyer (2) from his study of the species in Kansas gives the average life of the adults as about 18 days; the number of eggs laid, 10-50; the hatching period at ordinary room temperatures, 8-12 days, and the period in the larval stage about five months, subject to considerable variation depending on temperature and food conditions and other factors.

Origin: The probable origin of the infestations found in Canada is believed to be the United States. We have been informed that all the plants infested were largely equipped a few years ago by a firm in Detroit, Michigan, in which state the species is known to occur. Further, the waxed liners used in the barrels in which milk powder is shipped are also imported from the United States. It would be an easy matter for dermestids to be carried on such materials.

Control: This insect, like other dermestids, thrives best in protected situations where accumulations of food materials are allowed to remain undisturbed. Sources of infestation are cracks in old wooden floors and platforms, and on rafters, shelves, etc., where frequent cleaning may not be carried out. It is in such situations that the insect may multiply and from thence find its way into the finished dried milk product. It could not establish itself in the milk powder during its preparation, as in the final processing the product is passed through a drying silo in which the temperature is 180° F. This temperature, of course, would be quickly fatal to insects.

The prevention or control of infestations of these insects in dried milk plants should not prove difficult if those in charge observe the following suggestions. Actual or potential breeeding places should be reduced or eliminated by replacing old wooden floors and platforms by concrete; or, where this is not possible, by filling all unnecessary cracks and crevices with wood fibre or other suitable filler. In addition, the frequent use of plenty of hot water should be practiced, and other cleaning methods used to prevent the accumulation of milk powder dust in the building or its contents. Under certain conditions where no danger of tainting the product would result, a pyrethrum spray made of pyrethrum extract in refined kerosene could be used. Thoroughly scrubbing infested floors and other woodwork with an emulsion prepared from kerosene and soft soap in water, to which pyrethrum extract has been added immediately before using, should prove effective in destroying any larvae or other stages in hiding.

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AN ANNOTATED LIST OF THE PARASITES, PREDATORS, AND OTHER ASSOCIATED FAUNA OF THE MOUNTAIN PINE BEETLE IN WESTERN WHITE PINE AND LODGEPOLE PINE

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The mountain pine beetle (*Dendroctonus monticolae* Hopk.) has killed millions of trees during the past ten years in Montana, Idaho, and eastern Washington. It was during a serious epidemic of this beetle that the writer undertook a study of the economic importance and biology of its enemies in an effort to determine what insects were the most beneficial and to work out their seasonal history so that artificial control work could be instituted, if possible, at a time that would destroy fewer beneficial insects.

A study of the biology and morphology of the two most beneficial insects, *Coeloides dendroctoni* Cushm. (*Hymenoptera-Braconidae*) and *Medetera aldrichii* Wh. (*Diptera-Dolichopodidae*) is to be published elsewhere but it is believed that the following notes will be of value by contributing new host records and biological data.

These notes were made while an employee of the U. S. Bureau of Entomology, Division of Forest Insects. Acknowledgement is made to Dr. F. C. Craighead, Chief of the Division of Forest Insects, for permission to publish these records. Acknowledgement is also made to Mr. A. L. Gibson, H. J. Rust, W. D. Bedard, R. L. Furniss, J. Johnston, and F. B. Foley, who furnished data or assisted the writer at various times during the study.

The list is a record of the fauna that have been found associated in any way with the brood of the mountain pine beetle during the period that the trees are infested. No species are listed that were found in trees after the brood of the mountain pine beetle had emerged, with a few exceptions which are given because of unusual interest.

The notes comprising the list were made with but three or four exceptions, which are noted under the insect concerned, for lodgepole pine and western yellow pine near Sula, Montana, during August and September, 1928, and May to September, 1929; and for western white pine at Metaline Falls, Washington, 1930. Consequently, any mention of these trees gives the year and the region so that these are not given unless necessary for clearness. A few references are also included that were secured from records of the Forest Insect Field Station, Coeur d'Alene, Idaho.

The seasonal history of the mountain pine beetle in Montana and eastern Washington is roughly as follows: The beetles emerge during June, July and August from trees killed by their parents the previous season and attack healthy

lodgepole pine (*Pinus contorta* Loud.) and western white pine (*P. monticola* Doug.). Some of the brood from the early attacks of this beetle develops rapidly enough to complete development and emerge the latter part of August and perhaps September, but the main attack occurs during July and August. This is especially true in the lodge pole pine stands of Montana. The greater part of the brood winters over as partly grown larvae; development is completed the following spring; pupation occurs chiefly during June, and the beetles emerge about two weeks later. There is, however, considerable variation in the development of the brood especially in the western white pine stands of eastern Washington and there, a great percentage of the parent beetles emerge and cut a second set of egg galleries.

The name of the specialist who determined the specimens is given in double parenthesis after each name. The list below shows the abbreviations used. Where no specialist is given, the determinations were made by the writer by comparison with previously determined specimens in the station collection of the Forest Insect Field station, Coeur d'Alene, Idaho. The ants were compared by Mr. H. J. Rust with material collected by him in the same locality and determined for him by Mr. W. M. Mann.

J. M. Aldrich .....A.	H. E. Ewing .....E.
H. S. Barber .....Ba.	W. S. Fisher .....F.
M. W. Blackman.....Bl.	A. B. Gahan .....Ga.
A. G. Boving.....Bo.	C. T. Greene.....Gr.
J. C. Bradley.....Br.	Carl Heinrich .....He.
L. L. Buchanan.....Bu.	A. D. Hopkins .....Ho.
H. E. Burke.....Bur.	E. G. Lindsley .....L.
August Busck .....Bus.	William Middleton .....M.
A. N. Caudell.....Cd.	G. Steiner .....S.
E. A. Chapin.....Ch.	E. C. Van Dyke.....VD.

Where the names of two specialists appear after the same insect two different forms such as the larva and adult, or dimorphic adults were determined. Acknowledgement is made to all of these men.

Class Eunematoda.

NEMATODES

Family Rhabditidae.

Diplogaster occidentalis Steiner ((S)).

Family Anguillulinidae (Tylenchidae).

Aphelenchoides conurus Steiner ((S)).

Aphelenchoides acroposthion Steiner ((S)). These three new species were collected in western white pine under the bark of trees that had been killed the previous season or/and in trees that had been attacked not more than two weeks. It is possible that only one of the species was secured from trees recently attacked, as negligently all the nemas collected were placed in one vial.

Class Chilopoda.

ORDER ANAMORPHA

Centipedes were collected in May under the bark of western white pine. In captivity, they will feed on the larvae of *D. monticolae* and the larvae of *Coeloides dendroctoni* within their cocoons.

Class Arachnida.

ORDER PSEUDOSCORPIONIDA

Chelifer sp. ((E.)). Found occasionally in lodgepole and western white pine trees that were dead less than a year, but much more common in trees that had been dead for several years.

ORDER ARANEAE

Several undetermined species of spiders have been observed on the bark of both species of infested trees. One was observed to capture an adult *Coeloides dendroctoni* and another an adult *Medetera aldrichii* Wh.

Class Insecta.

ORDER NEUROPTERA

Family Chrysopidae.

Chrysopa sp. ((Cd.)). Predacious, but it is doubtful whether they prey on the larvae of the mountain pine beetle. One larva which was collected July 29, 1929, pupated between August 2 and 3; and emerged as an adult between August 20 and 21. Found only in lodgepole pine.

Family Raphidiidae.

Raphidia sp. These were found occasionally in lodgepole pine, but none in western white pine.

ORDER HEMIPTERA

Family Anthocoridae.

Several species, the determinations for which have not yet been secured, but which probably belong to this family, were collected on lodgepole pine most of the summer and on western white pine during May. They will feed on the larvae of the mountain pine beetle if the opportunity arises.

ORDER COLEOPTERA.

Family Carabidae.

Tachyta angulata Csy. ((Bu.)). Habits not known. One adult was collected under the bark of a lodgepole pine June 25, 1929.

Family Silphidae.

Leiodes globosa Lec. ((F.)). Probably saprophagous. One adult was collected July 19, 1928, on a lodgepole pine infested the previous year. None was found in western white pine.

Leiodes sp. ((F.)). Adults were collected during April and May in western white pine. None was found in lodgepole pine.

Family Corylophidae.

Sacium lugubre Lec. ((F.)). Probably saprophagous. One adult was collected in May and one in June on lodgepole pine.

Family Staphylinidae.

Tachyporus sp. ((Bo.)).

Gyrophaena sp. ((Bo.)).

Phloeonomus pusillus Grav. ((Ch.)).

Placusa sp.

Leptusa sp. Little was learned about the habits of any of these species. They were very abundant at times under the bark of infested trees, both in lodgepole pine and western white pine.

Nudobius. Predacious. Two undetermined species were secured; one occurred only in lodgepole pine and the other only in western white pine.

Quedius longipennis Mann. ((Ch.)). Predacious. This species was found only in lodgepole pine in May and in August.

Quedius sp. Predacious. An undetermined species which occurred only in western white pine, and was collected during May and June.

Family Histeridae.

Isolomalus mancus Csy. ((Ba.)). Both the larva and adult are predacious. In western white pine this was a rather common species. Adults and larvae were found early in the field season. A larva collected July 7, 1930, pupated between July 28 and 29 and the adult emerged between August 8 and 9. What appears to be the same species is less common in lodgepole pine but rather common in Montana in yellow pine infested with the mountain pine beetle.

Platysoma punctigerum Lec. Predacious. In yellow pine this was a very common species, in lodgepole pine less common, and in western white pine only one specimen was secured.

Plegaderus sp. Probably predacious. A rather common species in western white pine but in lodgepole pine only one specimen was secured.

Family Cantharidae.

Cantharis sp. ((Bo.)). Doubtfully predacious. It was found in lodgepole pine in the larval stages. Rare.

Family Melyridae.

Malachius sp. ((Bo.)). ((Ba.)). Doubtfully predacious. It occurred during July in lodgepole pine. It was rather uncommon.

Listrus sp. ((Ba.)). Doubtfully predacious. In lodgepole pine it was found during June and July in the adult stage.

Family Cleridae.

Enoclerus lecontei (Wolc.). Predacious. This is not a very common species either in lodgepole pine or western white pine.

Enoclerus sphegeus (Fabr.). Predacious. Adults are more common in western white pine than lodgepole pine, but it appeared to be of little economic value.

Thanasimus dubius Fab. Predacious. This is the most common of the three species in lodgepole pine and western white pine, but apparently it is not sufficiently abundant to be of economic value.

Family Othniidae.

Othnius sp. One adult was reared from a larva collected July 19, 1929, in a tree infested the previous year.

Family Pythidae.

Pytho planus Herbst. ((VD.)). Occasionally predacious. It is fairly common in lodgepole pine and western white pine. The adults were most numerous in May and June. In Washington 41 eggs were laid by one female between June 29 and July 1, 1930. The larvae were found practically all season.

Pytho sp. This species was found only in western white pine during May. Nothing is known of its habits, but they are probably the same as those of *P. planus* Herbst.

Family Elateridae.

Elater brevis Van Dyke ((VD.)). One was collected on lodgepole pine in May.

Limonius aeger Lec. ((VD.)). Collections were made from lodgepole pine in June.

Ludius propola (Lec.) ((VD.)). A few were observed on lodgepole pine in May and in June.

L. aereipennis (Kby.) ((VD.)). One was collected ovipositing in a lodgepole pine tree in June.

L. triundulatus (Rand.) ((VD.)) A fairly common species on lodgepole pine in June and July.

Family Buprestidae.

Dicerca tenebrosa Kirby ((Bur.)). A fairly common species during June and July on lodgepole pine.

Buprestis maculiventris Say. var. *rusticorum* (Kirby). Adults were found on lodgepole pine in late July and August.

Buprestis alternans (Lec.). Adults were found ovipositing on lodgepole pine late in July and August.

Melanophila intrusa Horn ((Bur.)). One adult was collected on lodgepole pine late in August.

Chrysobothris breviloba Fall ((Bur.)). Adults were observed on lodgepole pine in June, July, and August.

Family Ostomatidae.

Temnochila virescens (Fab.) var. *chlorodea* (Mann.). The adults and larvae are predacious but of no economic importance. Rather uncommon in lodgepole pine but more common on western yellow pine. The adults were found in the fall and the larvae were found in the spring. In western white pine larvae were found in early September and the following spring.

Family Nitidulidae.

Glischrochilus vittatus (Say) ((VD.)). Facultative predator. The adults were common in lodgepole pine all season except the first month after the new attack of the mountain pine beetle. The eggs were laid the middle of June. The larvae were common during June and July; pupae were secured during August. No individuals of the species or genus were found in western white pine.

Epurea lincaris Makl. ((VD.)) Doubtfully predacious. The adults have been observed feeding on the larvae of *D. monticolae* but it is probable that they began feeding after the larvae had died. They are common in lodgepole pine from one month to at least two years after the attack of the barkbeetle. What appears to be a different phase or species is commonly found in western white pine. An adult was observed in the laboratory to attack a pupa of *D. monticolae* but it was unable to pierce the pupal cuticula.

Family Rhizophagidae.

Rhizophagus procerus Csy. ((VD.)). Probably a facultative predator. It was common in lodgepole and western white pine the entire season. The adults and larvae have been observed feeding on the eggs and larvae of *D. monticolae* and other subcortical insect larvae.

Family Monotomidae.

Hespeobaenus abbreviatus Mots. ((VD.)). One adult was collected in September under the bark of a western pine, near Coeur d'Alene, Idaho, in 1929.
Family Cucujidae.

Laemophloeus angustulus Lec. ((VD.)). This species is probably predaceous on smaller insect larvae. It was found practically all season in lodgepole pine but it was less common in western white pine.

Cucujus clavipes Fabr. var. *puniceus* Mann. Predacious. It was rarely found in lodgepole pine, but it was rather common in infested western yellow pine in the same region. In western white pine they were fairly common in May.
Family Colydiidae.

Aulonium longum Lec. Probably faculative predator. It was rarely found in lodgepole pine, but it was abundant in western yellow pine in the spring in the same region. In western white pine, only one was observed in May.

Lasconotus pertenuis Csy. ((VD.)). It is probably predacious, but not on the larvae of the mountain pine beetle. Adults were found in lodgepole pine from May to September. They were very rare in western white pine, and were only observed during the latter part of July in a newly attacked tree.

Lasconotus simplex Lec. var. ((F.)). The habits are probably similar to *pertenuis*, though it was only found in lodgepole pine.

Lasconotus complex Lec. ((VD.)). Occasionally predacious. This species was the most common representative of this genus. It was more common in lodgepole pine, where it occurred all season, than in western white pine. In the former tree species, the eggs were laid about the middle of June. The incubation period is at least 5 days. The pupae were found the latter part of July and early August.

Lasconotus subcostulatus Kraus. ((VD.)). Adults were found in June in the tops of western white pine in the galleries of *Onthotomicus caelatus*.
Family Lathridiidae.

Corticaria serrata (Payk.) ((VD.)). Probably a scavenger. One adult was found the middle of July in lodgepole pine.
Family Tenebrionidae.

Corticeus parallelus (Melsh.) ((F.)). Facultative predator. The adults were found in lodgepole pine and western white pine. It was fairly common all season. In lodgepole pine one egg was secured in June; in western white pine several eggs were laid in May. The incubation period for one egg was 10 days.

Corticeus glaber (Lec.) ((F.)). Probably a facultative predator. The adults occurred both in lodgepole pine and western white pine from April to July, but they were less common than *H. parallelus*.

Bius estriatus Lec. ((VD.)). Habits not known. Adults were found in lodgepole pine in April, May, June, and early July.
Family Melandryidae.

Xylita laevigata Hellw. ((VD.)). Not predacious. The adults were fairly common on lodgepole pine from late May into August. The larvae were not observed.

Scotochroa basalis Lec. ((VD.)). Adults were found with the preceding species in lodgepole pine but were less common. The larvae were not observed

Rushia sp. ((Ch.)). An adult was collected on the bark of a lodgepole pine July 1, 1929.

Family Anobiidae.

Ernobius sp. ((F.)). One adult was collected June 10, 1929, ovipositing on lodgepole pine. Ten eggs were laid between July 1 and 10; they hatched between July 25 and 27.

Family Bostrichidae.

Adults and larvae of an undetermined species were collected in September in lodgepole pine.

Family Cerambycidae.

Spondylis upiformis Mann. The adults were common on lodgepole in June. They do not appear to be common in western white pine.

Asemum atrum Esch. The adults were most common in July on lodgepole pine.

Megasemum aspera (Lec.) ((F.)). A few adults were found on lodgepole pine and western white pine in August.

Stenocoris lineatum (Oliv.). On lodgepole pine they were found in late May and early June. On white pine a female was observed ovipositing May 27, 1929. The eggs hatched between June 5 and June 8.

Leptacmaeops alticola Csy. ((F.)). An adult was reared during the season of 1929 from a lodgepole pine tree caged within 4 weeks after the 1928 attack.

Anthophilax mirificus Bland. ((VD.)). ((F.)). Males were found on lodgepole pine in June, and one female was observed ovipositing in a tree June 22, 1929; others were found on July 1, 1929. One male was found on white pine in May. Adults were also collected from yellow pine at Sula, Montana, and alpine fir at Metaline Falls, Washington.

Anoplodera aspera (Lec.) ((F.)). Adults were found on lodgepole pine trees in July.

Xylotrechus undulatus (Say) ((VD.)). The adults were observed in August on lodgepole pine; in white pine one was found ovipositing on a tree attacked less than a week.

Monochamus oregonensis Lec. The adults were found late in July and August on lodgepole pine (and in western white pine in August. Doubtful record).

Monochamus obtusus Csy. Adults were found on bark of western white pine in October, 1929.

Acanthocinus obliquus Lec. This species occurred on lodgepole pine in July. Adults were found in July and August on western white pine. The larvae were very common in April, May, and June. At times they may be a valuable enemy of the brood of the beetle. Pupation generally occurs towards the end of July, either under bark or in the wood about an inch. The stadium of six pupae ranged from 12 to 18 days.

Pogonocherus sp. ((F.)). An adult was collected in May on a lodgepole pine.

Pogonocherus propinquus Fall ((L.)). An adult was reared by August from a lodgepole pine that was caged in early May, 1929.

Tetropium velutinum Lec. An adult was collected August 5, 1930, on a western white pine tree.

Family Curculionidae.

Cossonus piniphilus Boh. ((F.)). Adults were collected in July in western white pine attacked the previous year; Coeur d'Alene, Idaho.

Family Scolytidae.

Crypturgus borealis Sw. ((Bl.)). The adults were collected under the bark of western white pine during the spring and fall.

Polygraphus rufipennis (Kby.). The adults were collected underneath bark of western white pine during September.

Dendroctonus murrayanae Hopk. The adults were collected in the base of a lodgepole pine in late July and August.

Dendroctonus valens Lec. The adults were collected in the base of lodgepole pine late in July and August.

Hylurgops rugipennis (Mann.) ((Ho.)). The adults and larvae were collected in western white pine during June and July, Coeur d'Alene, Idaho.

Hylurgops subcostulatus (Mann.) ((Ho.)). The adults were collected in western white pine during June and July, Coeur d'Alene, Idaho, 1920.

Trypodendron rufitarsus (Kby.) ((Bl.)). The adults were collected from lodgepole pine in June.

Trypodendron bivittatum (Kby.) ((Ho.)). The adults were collected in June and July in western white pine, Coeur d'Alene, Idaho, 1920.

Pityophthorus burkei Blackm. ((Bl.)). The adults and larvae were collected in lodgepole pine during June and July.

Pityogenes fossifrons Lec. The adults and larvae were common under the bark of western white pine in June and July.

Pityogenes knechteli Sw. The adults were collected in association with *P. fossifrons* Lec.

Ips radiatae Hopk. The adults and eggs were collected in July in lodgepole pine attacked the previous August.

Ips vancouveri Sw. ((Bl.)). The adults were common in western white pine during August and September and the preceding spring.

Ips latidens (Lec.). The adults were collected in June and July in lodgepole pine, and from western white pine, Coeur d'Alene, Idaho, 1929.

Ips oregoni (Eichh.). New attacks were common during August and September in lodgepole pine.

Pityokteines elegans Sw. ((Bl.)). The adults were collected in August and the preceding spring in western white pine.

Onthotomicus caelatus (Eichh.) ((Bl.)). The adults were collected in lodgepole pine and western white pine in June and July.

ORDER LEPIDOPTERA

Family Blastobasidae ((H.)).

A larva of this family was collected May 18, 1929, under the bark of a lodgepole pine. A similarly appearing larva was collected in May in western white pine.

ORDER DIPTERA

Family Cecidomyidae.

Not predacious. The larvae of one or two undetermined species are common in lodgepole pine and western yellow pine in the same region in August and September, and the following spring.

Family Sciaridae.

Sciara sp. ((Gr.)). Not predacious. The adults are rather common on the bark of lodgepole pine in early June. Adults that appear to be of the same genus were abundant in August on the bark of western white pine.

Family Bibionidae ((Gr.)).

Not predacious. Larvae of this family were collected in May under the bark of lodgepole pine.

Family Xylophagidae.

Xylophagus abdominalis Loew. ((Gr.)). Predacious. This is a fairly common species in lodgepole and less common in western white pine. The adults were found on lodgepole pine during June and the first part of July. The eggs are laid under the bark during June.

Family Stratiomiidae.

Zabrachia polita Coq. ((Gr.)). One adult was collected on lodgepole pine in July, 1928. One larva was collected in a western white pine tree June 12. The larvae are generally found in trees dead more than a year.

Family Dolichopodidae.

Medetera aldrichii Wh. ((Gr.)). Predacious. The most valuable predator in lodgepole, western white pine, and probably western yellow pine.

Family Empididae.

Tachypeza corticalis Mel.? ((Gr.)). The adults were common on lodgepole pine all season; the larvae, however, have not been secured. Only one was observed in the western white pine stands.

Family Sarcophagidae.

Phaonia n. sp. ((A.)). Probably a facultative predator. A female was observed in August "ovipositing" in a western white pine. Larvae were collected in May and June, and one pupa in early July. In lodgepole pine a species which appeared to be the same was collected in the larval stage in June. They emerged as adults early in July. A gregarious chalcid was collected from the puparia of this species in western white pine.

Family Anthomyiidae ((Gr.)).

Larvae of this family were collected in May under the bark of lodgepole pine.

Family Lonchaeidae.

Lonchaea viridana Meigen. ((Gr.)). Facultative predator. Common. In lodgepole pine the adults were found from the latter part of May to September. The eggs were laid in August and September and are also probably laid the following spring. The incubation period requires five to six days. Puparia were found the latter part of June. In western white pine an adult was reared from a puparium 16 days after it had been formed. Their general seasonal history appeared to be about the same in the two regions. It is possible that some or all may have two generations a year.

ORDER HYMENOPTERA.

Family Tenthridinidae.

Amauronematis probably *borealis* Marl. ((M.)).

Amauronematis oregonensis Marl. ((M.)). The adults of these two species were reared during May from cocoons collected under the bark of lodgepole pine killed the previous year. Doubtless the trees were used only as a place for hibernation and post-feeding development.

Family Siricidae.

Xeris spectrum race *caudata* Konow. ((Br.)). The adults were observed ovipositing on lodgepole pine in late July and August.

Sirex californicus Ashm. ((Br.)) The adults were found ovipositing on lodgepole pine in late July and August.

Family Braconidae.

Coeloides dendroctoni Cush. ((Cu.)). Primary parasite; the most important. An account of its seasonal history and biology is to be given in detail in another publication.

Dendrosoter sp. ((Cu.)). This species is occasionally found on infested trees and in the laboratory larvae of the mountain pine beetle were freely parasitized, but in the field they were always found ovipositing on larvae of *Ips latidens* Lec. The egg resembles the egg of *Coeloides* and in the field the larvae are practically indistinguishable. In lodgepole pine the adults were common in late May. The incubation period ranged from 8 to 10 days. The feeding period of one larva occupied 24 days. Adults emerged in September from cocoons collected the end of August. At least one and a half generations or a partial multibrood are indicated with an emergence in September and the occurrence of adults in May. No adults were found on western white pine.

Meteorus hypophloei ((Cu.)). Parasite on the larvae of *Hypophloeus parallelus* Melsh. in lodgepole pine and western white pine.

Family Ichneumonidae.

Gelis sp. ((Cu.)). Secondary parasite. Adults were reared from the cocoons of *Coeloides dendroctoni* Cushm. in lodgepole pine.

Family Diapriidae.

Galesus nigricornis Ashm. ((Ga.)). Adults were reared in October, 1928, from undetermined dipterous skins (probably Psychodidae) collected under the bark of lodgepole pine abandoned by the mountain pine beetle.

Family Proctotrupidae.

Phaenoserphus abruptus (Say) ((Ga.)). Collected on western white pine during August and September. One female was observed to enter a beetle gallery by means of an exit hole made by a parent *D. monticolae*.

Family Encyrtidae.

New genus and species ((Ga.)). Several adults were collected during July, 1929, under the bark of lodgepole pine infested the previous year.

Family Chalcididae.

Heydenia hubbardi Ashm. ((Ga.)). Though found frequently on infested lodgepole pine it apparently does not parasitize the brood of the mountain pine beetle. It has been observed ovipositing over the gallery of *Ips latidens* Lec., *Pityogenes knechteli* Sw., and *Pityophthorus burkei* Blackm. One was also

reared from a hymenopterous cocoon collected from the gallery of *Ips latidens;* thus, it may be strictly a secondary parasite. It was not found on western white pine.

Family Eurytomidae.

Eurytoma n. sp. (Close to *pissodis* Gir.) ((Ga.)). A secondary parasite on *Coeloides dendroctoni* Cushm. It is abundant in lodgepole pine, but rare in western white pine. Some notes on its seasonal history and biology are in preparation.

Family Pteromalidae.

Pachyceras eccoptogasteri Ratz. ((Ga.)). Primary parasite. This is a fairly common species in lodgepole pine which was found the entire season beginning with late June. The female does not oviposit through the bark but enters ventilation holes of the beetle and oviposits through the sides of the egg galleries. What is probably the same species was also found in western white pine after June 6.

Eutelus sp. or *confusus* Ashm. ((Ga.)). Four adults were collected the latter part of July in a down lodgepole pine tree infested also with *Ips oregoni* Eichh.

Cecidostiba dendroctoni Ashm. ((Ga.)). Primary parasite. It is a common species in both lodgepole and western white pine. The female oviposits through the bark. The adults were found the entire field season beginning the latter part of May on both lodgepole and western white pine.

Cecidostiba acutus (Prov.) ((Ga.)). Primary parasite. It was found only in western white pine. The seasonal history is probably similar to that of *C. dendroctoni* Ashm. It is possible that this species was overlooked in lodgepole pine.

Apparently a new genus and species close to *Cecidostiba* ((Ga.)). Probably a primary parasite. Adults were collected on lodgepole pine May 28, 1929. They were common the day of collection.

Rhopalicus pulchripennis Cwfd. ((Ga.)). Primary parasite. The adults were a fairly common species on lodgepole pine the entire season beginning about the first of June. Indications are that it may also be occasionally a secondary on *Coeloides dendroctoni* or larvae of other parasitic hymenoptera, as a female was observed to go through the motions of oviposition in a hole previously bored by *Coeloides* and also one previously made by *Heydenia hubbardi* Ashm. No individuals of this species or genus were found in western white pine.

Family Formicidae.

Formica rufa var. *aggerans* Wh. The adults were collected on the bark of lodgepole pine during June and July.

Formica fusca var. *subaenescens* Emery. The adults were observed on the bark of lodgepole pine in June and July.

Componotus herculaneus var. *whymperi* Forel. The adults were observed in June on the bark of lodgepole pine.

Leptothorax sp. The adults were collected on an infested tree in July. (Lodgepole pine.)

NOTES ON THE BIOLOGY OF SIMULIUM PICTIPES HAGEN.

BY JOHN SMART,
Research Scholar of the Department of Agriculture for Scotland.

The occurence of numerous breeding areas of *Simulium pictipes* in the vicinity of Ithaca, N. Y., led the writer to make an investigation of its biology during the course of a year that he spent at Cornell University, while making a general study of the Simuliidae of the district.

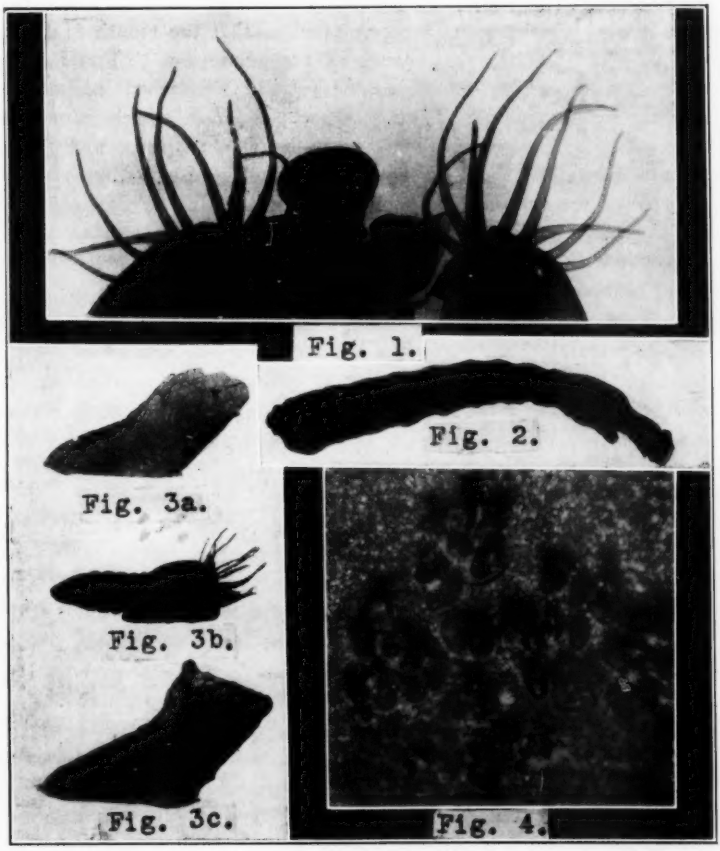
Observations on the Simuliidae in the vicinity of Ithaca have been published by Barnard (1880) and Howard (1888). In neither of these cases, however, was the species described identified, though in all probability it was *S. pictipes* that the writers were dealing with. The species itself was first described by Hagen (1879) from specimens taken in the Adirondack Mountains, N. Y., and full morphological descriptions of the larvae, pupa and imago were given by Johannsen (1903).

The egg of *S. pictipes* is ovoid, bulging slightly on one side but without the marked triangulate shape usually associated with the ova of the Simuliidae. It measures about .37mm.x.22mm.x.20mm. They are deposited on rock on the bed of the stream or much less frequently on aquatic vegetation. They are almost white when newly deposited but almost immediately assume a pale brown color which deepens to black as the larvae within develop. The eggs are occasionally scattered (fig. 4.) but more usually they are found in large masses, some of which may cover an area of over two square feet and situated at some point where a thin but continuous film of water passes over the rocks of the stream bed. Occasionally they may be found where the water film is discontinuous but here they are so placed as to be kept continuously wetted by spray or the periodical lappings of water from the main stream. The eggs are not orientated at all with reference to the current of the stream and the mass itself may consist of several layers of eggs all embedded in a common gelatinous matrix.

Large number of females oviposit at one place. They stand on the egg mass with their legs penetrating the thin layer of water flowing over it and, with their heads facing against the current, lay their eggs. Should the water film suddenly thicken they fly up only to alight again on the egg mass at some point where the water film is not so thick. Where egg-laying is being carried out at a place where the eggs are dependent on spray or the lapping motion of the water for their moisture, oviposition consists of a series of very short periods on the sub-stratum or egg mass and the females give the appearance of darting down, laying two or three eggs, and then rising up again. In no cases were females found fully submerged and actively ovipositing; live females were found in this situation but closer examination showed that these were hopelessly entangled in the gelatinous matrix of the egg mass which indicated that they had become submerged by a slight rise in the water level.

The incubation period of the eggs under laboratory conditions at about 25° C. was found to be about 2½ days though if the eggs were insufficiently oxygenated by being in the centre of the mass this period might be prolonged up to about 5 days. While the eggs can withstand exposure to air they will not withstand dessication; when subjected to drying the egg shells collapse and when

this happens the contained embryos are apparently destroyed. On the other hand they can withstand freezing for short periods in the laboratory and it was found that eggs might be frozen in solid ice and kept for a period of two days in this condition after which, when thawed out, they developed without any apparent abnormalities.



Simulium pictipes: Fig. 1—Pupal cuticle to show pupal respiratory filiments x18. Fig. 2—Mature larva. x6. Fig. 3—a. Cocoon; b. pupa; c. pupa in cocoon x6. Fig. 4—Eggs on rock surface. x19.

The newly hatched first instar when fully extended measures about .88mm. in length; it is characterized by the presence of an egg-burster on the dorsal surface of the head-capsule. On hatching they move away from the egg masses and into slightly deeper water where they settle down on the rocks and commence feeding.

As the larvae grow they move into deeper water until, when mature, the fully-grown larvae are to be found in the centre of the stream. Here they pupate. During the summer it was found that the larvae reached maturity and pupated in a period of from four to six weeks but it was found in the laboratory that

this period could be prolonged almost indefinitely if the supply of food was restricted. The overwintering larvae have a larval life of some six months duration.

The habits of the larvae of *S. pictipes* do not differ from those of other species of *Simulium*. When mature the tough boot-shaped cocoon, (fig. 3a.) in which pupation takes place, is spun on the rocky substratum on which the larvae have been living. The cocoons are orientated so that the mouth of the cocoon, with the head and respiratory filiments of the pupa (fig. 3b.) in it, lies down stream, the pupa being held in the cocoon (fig. 3c.) by means of hooks on the pupal cuticle. The pupal period occupies about 4½ days at laboratory temperatures of about 25° C. When ready to emerge the pupal cuticle splits longitudinally on the dorsal surface of the thorax and the adult fly on emerging is carried out of the mouth of the cocoon and up to the surface of the stream in a bubble of air that has accumulated within the pupal skin. As soon as the imagines reach the surface they fly off, their wings being ready for flight and not requiring any drying period.

The feeding habits of the adults of this species are not known. It does not appear to attack human beings in a state of nature but the writer has induced females to bite his arm in the laboratory.

When the flies are emerging from the masses of pupae in the stream, swarms of males may be seen hovering over and around these localities close to the surface of the water. The females as they emerge fly away from the pupating area pursued by two or three males. They fly upwards from the surface of the water and copulation apparently takes place in mid-air. The habits of the females from the time of mating to the time of ovipositing were not observed but chronological observations made in the field indicate that a period of about a week elapses between the emergence of the females and oviposition.

The occurrence of enormous numbers of males in the swarms alluded to above and the comparative paucity of females found in a wild state gives a false impression as to the sex-ratio of the adults. That the sex-ratio im approximately 50:50 with a slight preponderance of males during the whole season, was seen when pupae taken from the stream were reared in numbers in the laboratory. The occurrence of male swarms is accounted for by the fact that the males emerge earlier than the females though whether this was due to a shorter pupal period or to earlier pupation was not determined.

The stream (Fall Creek, Ithaca, N.Y.) in which the observations were made has a stone bottom and except where artificial weirs interfere it flows with considerable rapidity. For considerable stretches its bottom consists of loose stones and these parts are never inhabited by more than a few stray larvae of *S. pictipes*. Other shorter stretches, where the fall in the stream level is more rapid, have a solid rock bed, all loose stones there being swept away by the faster flow of water at these points. It is in these shorter stretches that *S. pictipes* abounds covering the rocks with a dense black mat of larvae which gradually turns to brown as the larvae spin their cocoons and pupate.

During the season (September, 1932-September, 1933) in which the observations, on which these notes are based, were made, four distinct generations of

the fly were passed through and it is very probable that the very extended duration of the fourth generation indicates that two overlapping generations were involved making five generations in all throughout the year. Collections made in December showed that the whole of the larval population were about three-quarters grown and that there was very little variation in the size of the larvae. The greatly increased volume of water flowing in the Spring made observations then somewhat difficult. First stage larvae were, however, found in the second week of April and a few days later, when permitted by a drop in the water level, an examination of the main bed of the stream showed the presence there of a few mature overwintering larvae, some pupae and numerous empty pupal skins and cocoons. Only eggs laid during the first two weeks of April could hatch since after that time the gradual recession of the water level left the eggs out of the water and the resulting dessication killed them.

The larvae of this first or Spring generation became fully grown and pupated in about six weeks and practically all had done so by the end of May. At first, when small, they were located on submerged rocks at the side of the stream but as they grew they passed into deeper water and eventually they pupated in the main bed of the stream.

Oviposition by the imagines of the first or Spring generation commenced late in May and extended into the first two weeks of June. At first the larvae from these eggs grew rapidly and evenly but gradually it became apparent that some, owing, presumably, to being located in less favorable situations, were not growing so fast. Adults of this second generation appeared in July and oviposition commenced in the second week of that month. Some of these third generation larvae grew rapidly but by the end of July it was impossible to say whether a mature larva was a slow growing member of the second generation or a rapidly growing member of the third, and throughout the remainder of the summer it was possible to find ova, larvae at all stages, pupae and imagines in the one locality.

Observations made on the same species in another locality showed that where conditions were favorable there was no slowing down in the general rate of development and it would therefore seem highly probable that during the rest of the summer at least one if not two generations appeared before the overwintering one, making a total of four or possibly five generations in the year.

Acknowledgements: The observations recorded above were made while the writer was spending a year at Cornell University as holder of a Research Scholarship from the Department of Agriculture for Scotland. Laboratory facilities and accommodation were generously provided by the Entomology Department of the New York State College of Agriculture at Cornell University and the writer is deeply indebted to Professor R. Matheson of that Department for his personal interest in the work and for the many helpful suggestions made by him as it progressed.

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THE AMERICAN SPECIES OF DALOPIUS ESCH. (ELATERIDAE, COLEOP.)*

BY W. J. BROWN.
Ottawa, Ontario.

(continued from page 39)

3. **Dalopius vagus** n. sp.

Male. Length 6.2 mm. Very dark brown; the antennae a little paler, the basal segments, the apical margin and posterior angles of prothorax, a spot on humeral umbone of each elytron half the size of the scutellum, and margins of apical abdominal segment reddish-yellow; the legs very pale reddish-yellow.

Antenna surpassing the pronotal angle by the length of two segments; the fourth segment two-thirds as long as segments two and three together. Pronotum as wide as long; the posterior angles moderately produced. Propleuron deeply emarginate and strongly angulate, the angle obtuse but very distinct. Elytron very distinctly truncate.

Length of aedeagus 1.06 mm.; lateral lobe with a strong shoulder on the outer margin, the apex emarginate and with the inner angle membranous; median lobe laterally compressed, its thickness subequal to its width, bicarinate, the carinae separating the dorsal from the lateral faces.

Female. Antenna surpassing the pronotal angle by the length of one segment.

Holotype—♂, Blackburn, Ont., June 2, 1932, (W. J. Brown); No. 3545 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—5♂, 6♀, same data; 1♂, 1♀, same data, June 6; 1♂, 1♀, same data, June 13; 2♂, 3♀, Mer Bleue, Ont., June 13, 1932, (W. J. Brown); 1♂, Mer Bleue, Ont., June 1, 1928, (W. J. Brown); 3♂, 2♀, Galetta, Ont., June 13, 1932, (W. J. Brown); 1♂, 1♀, Carp, Ont., July 5, 1932, (W. J. Brown); 3♂, Leamington, Ont., June 24, 26, and 27, 1931, (W. J. Brown); 1♂, Hillier, Prince Edward Co., Ont., June 10, 1911 (Evans); 1♂, 1♀, Fisher Glen, Ont., June 11 and 16, 1931, (W. J. Brown); 2♂, Ottawa, Ont., May 16 and July 1, 1914, (G. Beaulieu); 6♂, Delhi, Ont., June 2, 1931, (W. J. Brown); 1♂, Toronto, Ont., June 15-30, 1927, (L. J. Milne); 1♂, Gravenhurst, Ont., July 1, 1932, (G. M. Stirrett); 1♂, Sackville, N. B., July 5, 1928, (W. J. Brown); 1♂, Fredericton, N. B., July 16, 1928, (W. J. Brown); 12♂, 6♀, Aylmer, Que., June 11, 13, 17, and 30, 1932, (W. J. Brown); 4♂, Wakefield, Que., June 15, 1932, (W. J. Brown); 12♂, 6♀, Knowlton, Que., June 6 to July 13, 1927 to 1930, (J. A. Adams, G. H. Fisk, L. J. Milne, G. S. Walley, W. J. Brown); 1♂, Meach Lake, Que., June 21, 1916, (A. Gibson); 13♂, 9♀, Aweme, Man., June 1 to July 23, 1912 to 1924, (A. Gibson, J. B. Wallis, N. Criddle, E. Criddle); 1♀, Onah, Man., June 15, 1920, (S. Criddle); 1♂, Fairmont, W. Va., 1928, (P. N. Musgrave).

The paratypes measure from 5.2 to 7 mm. in length; those from eastern Canada average a trifle larger than those from Manitoba. In a few of the

specimens, the humeral spot of the eytron is indistinct; in most it is not more than twice as large as the scutellum; in none is it more than three times as large as the scutellum except in the two specimens from Sackville, N. B., and Fairmont, W. Va. In both of these, the spot is produced to form a vitta which reaches the apex and occupies about one-third of the elytron. The Sackville specimen resembles *vernus* in color; the Fairmont specimen resembles *gentilis*. In some specimens, the angle of the propleuron is rounded and obsolete, but the emargination is always deep. The elytron is always very distinctly truncate. In some females the antenna is a little longer than in the allotype, surpassing the pronotal angle by the length of one and one-half segments. The aedeagus varies little. It measures from .99 to 1.17 mm. Occasionally the median lobe is more strongly compressed than in the type. The carinae are then more approximate, and the lobe is narrower. In all specimens, the basal extremities of the lateral lobes are approximate, being forced together by the narrow basal piece as in the type.

The present species is very abundant in eastern Canada. It frequently occurs with *cognatus* which is usually slightly larger but which differs constantly only by the characters of the aedeagus. Normally colored examples also resemble closely several other eastern species, especially *insolitus, brevicornis, virginicus* and some specimens of *vernus*.

4. **Dalopius insolitus** n. sp.

Male. Length 6.5 mm. Reddish-brown, the margins of the pronotum paler; humeral umbone of each elytron, basal antennal segments, labrum, and legs reddish-yellow.

Antenna surpassing the pronotal angle by the length of one and one-quarter segments, the fourth segment two-thirds as long as the second and third united. Pronotum as long as wide, the posterior angles moderately produced. Propleuron deeply emarginate, obtusely angulate. Elytron truncate at apex.

Length of aedeagus .90 mm.; the basal piece short and wide, its emargination very shallow; median struts wide; ventral face of median lobe bearing a large, elongate, sclerite (represented in the drawing by the line formed of dots and dashes).

Female. Antenna surpassing the pronotal angle by the length of one segment.

Holotype—♂, Point Pelee, Ont., June 6, 1929, (G. S. Walley); No. 3546 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—1 ♂, 7 ♀, same locality, June 6 to 25, 1925, 1929, and 1931, (G. S. Walley, L. J. Milne, and W. J. Brown); 1 ♂, Aylmer, Que., June 11, 1929, (W. J. Brown).

The paratypes measure from 6 to 6.7 mm. Several of the paratypes lack the humeral spot; in several the spot is prolonged to form a narrow, rather obscure vitta which extends to the apical fourth of the elytron in one specimen. In one specimen, the labrum is as dark as the front; in all of the others, it is pale reddish-yellow as in the holotype. In one specimen, the angle of the propleuron is obsolete; in all, the elytron is distinctly truncate. The species differs from the other medium sized, dark species of the east in being dark reddish-brown rather than blackish and in having the labrum pale.

It presents no unusual characters except those of the aedeagus which measures from .85 to .95 mm. The basal piece and median struts are very unusual in form. The sclerite attached to the ventral face of the median lobe is heavy, darker in color than the median and lateral lobes, and characteristic of the species. It may be homologous with the chitin rod described by Sharp and Muir (1912, Trans. Ent. Soc. Lond., pt. 3, 545, pl. LXVI, fig. 154) in *Agrypnus* sp. (?). In all of the other species considered in this paper, the chitin rod occurs in the same position as a small, needle-shaped sclerite.

5. **Dalopius fuscipes** n. sp.

Male. Length 7.3 mm. Blackish, the posterior pronotal angles not paler, the elytra immaculate, the basal segment of antenna, apical margin of pronotum, and legs dark reddish-brown.

Antenna surpassing the pronotal angle by the length of two and one-half segments; the fourth segment three-fourths as long as the second and third united. Pronotum as long as wide, its posterior angles moderately produced. Propleuron deepy emarginate, not angulate. Elytron rounded at apex.

Length of aedeagus .92 mm.; the form much as in *vernus* but with the lateral lobes more strongly narrowed apically.

Holotype—♂, Potton Springs, Que., July 6, 1928, (G. H. Fisk); No. 3547 in the Canadian National Collection, Ottawa.

The species is closely allied to *pennsylvanicus*. To this species I refer a female specimen taken at Knowlton, Que., which measures 7.8 mm. On account of its large size, dark pronotal angles and legs, rounded elytral apex, and long antennae, it seems to belong with *fuscipes* rather than with *cognatus*.

6. **Dalopius pennsylvanicus** n. sp.

Male. Length 8.4 mm. Reddish-brown, the margins of the pronotum slightly paler than the disk, elytra immaculate, three basal segments of antenna and legs reddish yellow.

Antenna surpassing the pronotal angle by the length of two segments, the fourth segment three-fourths as long as the second and third united. Pronotum as long as wide, the posterior angles moderately produced. Propleuron deeply emarginate and strongly angulate. Elytron very strongly truncate at apex.

Length of aedeagus .99 mm., its form as in *fuscipes*.

Female. Antenna as in the male.

Holotype—♂, Pittsburgh, Pa., June, 1929, (F. H. Chermock); No. 3548 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—5♂, 9♀, same data; 1♀, same data, June, 1930; 1♂, Pennsylvania, (Dietz).

The paratypes measure from 7.6 to 9 mm. Several of the specimens are very dark brown, and in several, the pronotal margins are not paler. Several have a small humeral spot which, in one specimen, extends over the basal quarter of the elytron as a short vitta. The legs are pale in all. In all, the elytron is very strongly truncate and in all but one, the propleuron is strongly angulate. The aedeagus does not vary in length. On comparison, the aedeagus of *pennsylvanicus* is seen to have the apical portion of the lateral lobe a trifle shorter than in *fuscipes* and the median lobe very slightly narrower and perfectly parallel,

not slightly narrowed at middle as in the allied species. These differences are very slight but probably constant, as they hold constant in the limited number of specimens at hand. The present species is characterized by its large size, color, truncate elytron, and angulate propleuron. It resembles closely none of the eastern species except *fuscipes*.

7. **Dalopius vernus** n. sp.

Male. Length 5.6 mm. Very dark brown; antennae brownish-yellow, the basal segments, apical margin and posterior angles of prothorax, a vitta on each elytron, and margins of apical abdominal segment reddish-yellow; the elytral vitta extending from the humeral umbone to apical third, as wide as three intervals in its basal half, narrowed apically; legs very pale reddish-yellow.

Antenna surpassing the pronotal angle by the length of one and three-quarters segments; its fourth segment two-thirds as long as segments two and three together. Pronotum as long as wide; its posterior angles moderately produced. Propleuron deeply emarginate, obtusely angulate. Elytron rounded at apex.

Length of aedeagus .76 mm.; apical portion of lateral lobe with the external margin moderately arcuate; median lobe not constricted at middle.

Female. Antenna surpassing the pronotal angle by half the length of a segment.

Holotype— ♂, Aylmer, Que., June 11, 1932, (W. J. Brown); No. 3549 in the Canadian National Collection, Ottawa.

Allotype— ♀, same data.

Paratypes—4 ♂, 6 ♀, same data; 1 ♂, same data, May 12, 1932; 1 ♂, same locality, May 8, 1921, (G. Beaulieu); 1 ♂, Blackburn, Ont., June 2, 1932, (W. J. Brown); 2 ♂, 3 ♀, Husavick, Man., June 23, 1912, and July-Aug., 1922, (J. B. Wallis and E. Coates); 1 ♀, Winnipeg, Man., June, 1914, (L. H. Roberts).

The paratypes measure from 5 to 6.3 mm. In one specimen, the elytral vitta extends almost to apex; in several it is reduced to an elongate humeral spot. The vitta is usually rather obscure and indistinct beyond the basal half of the elytron. The angle of the propleuron is usually obsolete, and the elytron is always distinctly rounded at the apex. The aedeagus measures from .72 to .82 mm. The species resembles *vagus* and *brevicornis* but differs from those and the others with which it might be confused in having the elytral apex rounded.

8. **Dalopius brevicornis** n. sp.

Male. Length 5.4 mm. Very dark brown; the basal segments of antennae, apical margin and posterior angles of thorax, a humeral spot on each elytron four times as large as the scutellum, and the margins of the apical abdominal segment reddish-yellow; the legs very pale reddish-yellow.

Antenna just attaining the apex of the pronotal angle; the fourth segment two-thirds as long as segments two and three together. Pronotum slightly wider than usual, its length equal to nine-tenths its width; the posterior angles moderately produced. Propleuron deeply emarginate and obtusely but distinctly angulate. Elytron distinctly truncate.

Length of aedeagus .62 mm.; apical portion of lateral lobe with the external margin strongly arcuate; median lobe slightly but distinctly constricted at middle.

Female. Antenna failing to attain the pronotal angles by a distance equal to half the length of the apical segment.

Holotype—♂, Aylmer, Que., June 11, 1932, (W. J. Brown); No. 3550 in the Canadian National Collection, Ottawa.

Allotype—♀, same data.

Paratypes—5♂, 5♀, same data; 2♂, Go Home Bay, Ont., June 18, 1932, (G. S. Walley).

The paratypes measure from 5.2 to 5.9 mm. The humeral spot is sometimes smaller than in the type. In some specimens it forms a wide vitta on the basal third of the elytron. The angle of the propleuron is very distinct in all specimens. The aedeagus varies in length from .60 to .67 mm. The present species cannot be separated from *gentilis* and *agnellus* by the characters of the aedeagus but is readily separated by the color characters. All of the other species with which *brevicornis* might be confused on account of its color have longer antennae. In *vernus*, which is closely allied to and occurs with *brevicornis*, the antennae are longer, each elytron is rounded at apex and usually more strongly vittate, the prothorax is a little less robust, and the lobes of the aedeagus are different in form.

9. **Dalopius agnellus** n. sp.

Male. Length 5.4 mm. Blackish; antennae brown, the basal segments, apical margin and posterior angles of prothorax, an entire vitta on each elytron, and legs reddish-yellow; the elytral vitta occupying four intervals from the umbone to apical third, then widened slightly and joining the sutural and lateral margins at apical sixth.

Antenna surpassing the pronotal angles by three-fourths the length of a segment; the fourth segment two-thirds as long as the second and third segments united. Pronotum as wide as long, its posterior angles moderately produced, its punctures closer than usual. Propleuron deeply emarginate and obtusely but strongly angulate. Elytron subtruncate.

Length of aedeagus .58 mm., its form as in *brevicornis*.

Female. Antenna just attaining the apex of the pronotal angle.

Holotype—♂, South Bolton, Que., June 19, 1928, (W. J. Brown); No. 3551 in the Canadian National Collection, Ottawa.

Allotype—♀, same locality, June 16, 1928, (G. H. Fisk).

Paratypes—2♂, 2♀, same data as holotype; 1♂, 2♀, same data as allotype; 2♂, 3♀, Knowlton, Que., June 12, 15, and 29, 1928, (W. J. Brown) and July 13, 1929, (L. J. Milne); 2♂, Boiestown, N. B., July 11, 1928, (W. J. Brown).

The paratypes measure from 5.4 to 6 mm. In several, the pale area of the elytron is larger, the vitta joining the sutural margin at middle. In two specimens the elytron is pale with the sutural margin in basal half and the lateral margin in basal two-thirds narrowly brown. In some specimens, the elytron is rounded at apex, in others it is subtruncate. The aedeagus measures from .56 to .63 mm. and does not differ from that of *brevicornis*. The present species is characterized by the short antennae, the densely punctate pronotum, and the broad elytral vitta which contrasts sharply with the blackish pronotum.

10. **Dalopius gentilis** n. sp.

Male. Length 5.7 mm. Blackish, antennae brown, the basal segments, pronotal margins, a vitta on each elytron, apical abdominal segment except at base, and the legs reddish-yellow; the pale areas broad on the sides of pronotum and prothoracic venter, narrow on base and apex of pronotum; the elytral vitta occupying four intervals, slightly wider in apical third, joining the lateral and sutural margins near apex.

Antenna surpassing the pronotal angle by the length of two segments; the fourth segment two-thirds as long as segments two and three united. Pronotum as wide as long, its posterior angles moderately produced. Propleuron deeply emarginate and subangulate. Elytron truncate.

Length of aedeagus .63 mm., its form as in *brevicornis*.

Female. Antenna surpassing the pronotal angle by the length of one segment.

Holotype—♂, Go Home Bay, Ont., July 5, 1932, (G. S. Walley); No. 3552 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, July 6, 1932.

Paratypes—6♂, 12♀, same data, June 24 to July 11, 1932; 1♂, Knowlton, Que., June 29, 1930, (L. J. Milne).

The paratypes measure from 5.7 to 6.6 mm. The pronotum, in all specimens, is margined with reddish-yellow, broadly so in some, narrowly but distinctly so in others; the dark central area is sometimes brown. The elytral vitta is sometimes wider than in the type; sometimes it occupies the entire disk except a broad sutural and a narrow lateral blackish margin which do not attain the apex. The angle of the propleuron is always feebly defined, and the elytra are always distinctly truncate. The aedeagus measures from .63 to .67 mm. and does not differ from that of *brevicornis*. The female antenna shows considerable variation, surpassing the pronotal angle by a distance equal to one-half a segment in one specimen and by one and one-half segments in another. The present species differs from others occurring in the same region, except *pallidus*, by the color of the pronotum. In *pallidus* the antennae are pale yellow, and the general color is paler.

11. **Dalopius parvulus** n. sp.

Male. Length 4.4 mm. Reddish and yellow; the venter except the propleura, the elytral vittae, and the head reddish-brown; the pronotal disk reddish except near its margin; each elytron yellow with sutural and lateral vittae extending almost to apex; each vitta occupying two intervals, the sutural narrowed in apical third and extending to the humeral umbone at base.

Antenna surpassing the pronotal angle by the length of one and three-quarters segments; the fourth segment two-thirds as long as the second and third united. Pronotum very slightly longer than wide, its posterior angles rather feebly produced. Propleuron feebly emarginate, not angulate. Elytron rounded at apex.

Length of aedeagus .67 mm., the color paler than usual.

Female. Antenna surpassing the pronotal angle by half the length of a segment.

Holotype—♂, St. Gregor, Sask., August 8, 1930, (Robert Glen); No. 3553 in the Canadian National Collection, Ottawa.

Allotype—♀, same data, August 1, 1930.

Paratypes—2♂, 2♀, same data, August 4, 6 and 12, 1930; 1♂, Estevan, Sask., May 21, 1916, (N. Criddle); 1♂, 1♀, Marysburg, Sask., July 14 and 26, 1930, (Robert Glen); 5♂, 3♀, Winnipeg, Man., May 13 and 20, 1911, (J. B. Wallis).

The paratypes measure from 4.3 to 5.1 mm. In most of them, the pronotum is not longer than wide, and in one female, the antenna does not quite attain the apex of the pronotal angle. The dark elytral vittae may be a little wider than in the type. Frequently the vittae are shorter, and occasionally the lateral vitta is subobsolete. In one specimen, the elytra are entirely pale except at the extreme base.

The aedeagus measures from .65 to .69 mm.

The species is characterized by its color and small size, but may be confused with small examples of *pallidus*. The elytra in the latter are distinctly reddish, not yellow as in the present species.

(to be continued)

HELICHUS PUNCTICOLLIS SHARP IN ARIZONA (DRYOPIDAE, COLEOPTERA)

BY HOWARD E. HINTON,
Berkeley, California.

Helichus puncticollis Sharp.

Sharp, Biol. Centr.-Amer., V. 1, pt. 2, p. 121, 1882.
Sharp, Biol. Centr.-Amer., V. 1, pt. 2, Supp. p. 774, 1887.

This species was recorded from Arizona by Sharp in 1887, yet no mention of it is made in Leng's Catalogue of the Coleoptera of America, North of Mexico. This omission should be corrected in the next Supplement.

Helichus puncticollis Sharp belongs in that group of the genus having the apical ventral segment not densely pubescent. From the species in this group it may be distinguished by its superior size, 6.5-7.5 mm., and coarsely and densely punctate pronotum.

Date of Mailing, March 31, 1934.